Investigations on a fuzzy logic based SVC Damping controller

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CERTIFICATE

This is to certify that **Ms. Monalisa**, a student of final semester **M.Tech (Power Systems)**, Electrical Engineering Department, during the session 2010-2012 has successfully completed the project work on **"Investigations on a fuzzy logic based SVC Damping controller"** and has submitted a satisfactory report in partial fulfillment for the award of the degree of **Master of Technology (Power Systems)** in Electrical Engineering Department.

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ABSTRACT

Power systems all over the world have grown exponentially with time. Since acquiring right-of-way for laying of new transmission lines have been increasingly more difficult in light of economic, legislative and environmental problems, more and more power has to be pushed through the already stressed existing transmission corridors. This may result in low frequency oscillations typically in the range of 0.1-2 Hz. These low frequency oscillations may be exhibited as synchronous machines oscillating against one another, or a group of machines oscillating with respect to another group. Traditional approach to address this problem has been to equip PSS in the machines which has tendency to damp out power oscillations.

Ever since the FACTS technology was initiated by the EPRI in the 1980's, a number of power electronics based FACTS Controllers have evolved, which modify the existing power system parameters to effect rapid controllability of existing power transmission capabilities.

Static Var Compensator (SVC) was one of the earliest FACTS Controllers to be used for voltage control and stability improvement of power networks. Modulation of the SVC susceptance using supplementary control signals like generator speed deviation, line current etc in conjunction with the SVC voltage controller can be used to damp power system oscillations. In addition, fuzzy logic based damping controllers came into existence, which proved to be more effective in damping power system oscillations than conventional ones.

In this work, a conventional and a fuzzy logic based SVC damping controller is developed for power oscillation damping. Different supplementary control signals have been adopted for both these controllers and the small signal stability of the system is studied. A comparison of the responses indicates that fuzzy logic based SVC damping controllers exhibit better performance characteristics than conventional ones.

CONTENTS

LIST OF SYMBOLS

SYMBOLS	QUANTITY
$X_d{}'$	Generator transient reactance (d-axis)
X_{trf}	Transformer reactance
X_E	Transmission line reactance
δ	Rotor angle
w_r	Rotor speed
$\Delta\delta$	Rotor angle deviation
Δw_r	Rotor speed deviation
$\Delta\dot{w}_r$	Deviation in rotor acceleration
ΔT_m	Deviation in mechanical torque
H	Inertia constant (in Mw.sec/MVA)
B_{SVC}	Suscptance of SVC
$\Delta\ B_{SVC}$	Deviation in suscptance of SVC
$E^{'}$	Generator internal voltage behind transient reactance
E_B	Infinite bus voltage
E_t	Generator terminal voltage
K_r	SVC voltage controller gain
T_r	Time constant of SVC Voltage controller
P	Active power
Q	Reactive power
I_1	Line current magnitude (rms value)
I_2	Line current magnitude (rms value)
I_3	Magnitude of current drawn by SVC (rms value)

$c1, c2, c1', c2'$	Gain constant
V_m	Magnitude of voltage at SVC bus
K_b	Damping controller gain
T_1 , T_2	Time constant of damping controller

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